

**REMARKS**

Entry of the foregoing, re-examination and reconsideration of the subject matter identified in caption, as amended, pursuant to and consistent with 37 C.F.R. §1.111, and in light of the remarks which follow, are respectfully requested.

Claim 1 has been amended to incorporate the subject matter of claim 2. Claim 2 has been canceled without prejudice or disclaimer. No new matter has been added.

Upon entry of the Amendment, claims 1 and 3-5 will be all the claims pending in the application.

**I. Response to Rejection under 35 U.S.C. § 103(a)**

Claims 1-5 were rejected under 35 U.S.C. § 103(a) as allegedly obvious over Japanese Patent Document No. JP 2003/183453 ("*Toyoda*"). Applicants respectfully submit that the claims as amended are patentable over *Toyoda* for at least the following reasons.

Sole independent claim 1 recites an additive for a printing ink comprising a polyethylene-based wax specified by the following (i) to (vii):

- (i) being an ethylene homopolymer or a copolymer of ethylene and at least one  $\alpha$ -olefin selected from  $\alpha$ -olefins having 3 to 20 carbon atoms,
- (ii) having the intrinsic viscosity  $[\eta]$  determined in decalin at 135°C ranging from 0.06 to 0.35 dl/g,
- (iii) having the ratio (Mw/Mn) of weight average molecular weight (Mw) to number average molecular weight (Mn) determined by gel permeation chromatography (GPC) ranging from 1.7 to 3.2,

(iv) having the ratio ( $M_z/M_w$ ) of z-average molecular weight ( $M_z$ ) to weight average molecular weight ( $M_w$ ) determined by gel permeation chromatography (GPC) ranging from 1.5 to 2.0,

(v) having the density ranging from 920 to 980 kg/m<sup>3</sup>,

(vi) having the penetration hardness of 5 dmm or less, and

(vii) having the acid value ranging from 0.3 to 9.9 KOH-mg/g, and

wherein the polyethylene-based wax is produced with a metallocene-based catalyst and is subjected to oxidative modification.

The present specification demonstrates that the polyethylene-based wax as defined in present claim 1 can provide unexpected results and thus further supports the patentability of the present claims.

Specifically, Table 1 of the present specification shows polyethylene waxes of sample 1-E and sample 2-E both having physical properties within the scope of present claim 1, as well as HW210MP having an  $M_z/M_n$  value of 2.4 which was outside the range recited in present claim 1, and HW4102 having an  $M_z/M_n$  value of 2.1 and an acid value of 0 KOH-mg/g both of which were outside the ranges recited in present claim 1.

As can be seen from the data in Table 3 of the present specification, Examples (Inks 1-2) containing polyethylene waxes of sample 1-E and sample 2-E, respectively, exhibited superior results to Comparative Example (Ink 3) containing HW210MP in terms of abrasion resistance and blocking resistance in evaluation as a printing ink.

In addition, as can be seen from the data in Table 2 of the present specification, Examples (Dispersions 1-2) containing polyethylene waxes of sample 1-E and sample 2-E, respectively, exhibited superior results to Comparative Example (Dispersion 4) containing HW4102 in terms of storage stability in evaluation as a solvent dispersion.

*Toyoda* discloses an aqueous dispersion of an ethylene-based polymer composition comprising (A) an ethylene-based polymer having an Mn of 400-8,000, an Mw/Mn of 3 or less, a specific relation between a crystallization temperature and a density that is in the range of 850-980 kg/m<sup>3</sup> and a volume average particle size of 0.1-20 μm, and (B) a modified ethylene-based polymer being modified with the unsaturated carboxylic acid or its derivative and having an acid value of 30-100 KOH-mg/g, or modified with a sulfonate and having its content of 0.1-50 mmol equivalents in terms of -SO<sub>3</sub>- per gram of the modified polymer (claims 1 and 4).

*Toyoda* also discloses (A) an ethylene-based polymer is produced with a metallocene catalyst (claim 2) and a ratio of (A) to (B), (A/B), is in the range of 95/5-50/50 by weight (claim 3).

However, *Toyoda* fails to disclose a polyethylene-based wax which is produced with a metallocene-based catalyst and is subjected to oxidative modification, and having (iii) an Mw/Mn ranging from 1.7 to 3.2, (iv) an Mz/Mn ranging from 1.5 to 2.0, (v) a density ranging from 920 to 980 kg/m<sup>3</sup>, and (vi) a penetration hardness of 5 dm or less, as recited in present claim 1.

Moreover, *Toyoda* teaches (B) a modified ethylene-based polymer having an acid value of 30-100 KOH-mg/g which is outside the range recited in present claim 1. *Toyoda* further describes that when the acid value is within these limits, “the hygroscopic property of the particles obtained from a water dispersing element is moderate, and there is tendency to excel in a water resisting property, weatherability, etc. Moreover, the phase inversion after water addition is enough, and there is a tendency for a water dispersing element to be obtained with high yield” (paragraph [0113] of the English translation). As such, *Toyoda*

teaches away from a polyethylene-based wax having (vii) an acid value of 0.3-9.9 KOH-mg/g, as recited in present claim 1.

Still further, *Toyoda* describes only an acid value of the ethylene-based polymer and a kind of acids to modify the polymer, and does not provide any suggestion in arriving at the polyethylene-based wax recited in present claim 1. In addition, Applicants advise that the graft-modified polyethylene wax with an unsaturated carboxylic acid or its derivative or with a sulfonate as taught by *Toyoda* tends to separate in an organic solvent due to too high acidity originating from its structure. Moreover, stable production of a graft-modified product with extremely low acidity is difficult for industrial applicability.

The Office Action asserts that "It is further disclosed [in *Toyoda*] that the polyethylene wax is synthesized using metallocene catalyst and is subjected to oxidative modification (claim 2-3)" (page 3, lines 9-10 of the Office Action).

*Toyoda* only discloses a graft-modified ethylene-based polymer with an unsaturated carboxylic acid or its derivative or with a sulfonate having high acidity (claim 1 and working examples). However, *Toyoda* does not disclose oxidative modification, e.g., by air, as recited in present claim 1 and exemplified in the working examples of the present specification.

It is well known to a person having ordinary skill in the art that an ethylene-based polymer produced by oxidative modification, such as that defined in present claim 1, has not only a carboxylic acid group, but also a carbonyl group, a carboxylic acid ester group or a hydroxyl group in the molecule.

Thus, the ethylene-based wax recited in present claim 1 differs from the graft-modified ethylene-based polymer of *Toyoda* not only in terms of the acid value but also the structural features. Moreover, *Toyoda* is silent regarding the above noted unexpected results obtainable in the presently claimed invention.

In view of the foregoing, Applicants respectfully submit that present claim 1 is patentable over *Toyoda*, and thus the rejection should be withdrawn. Additionally, claims 3-5 depend from claim 1, directly or indirectly, and thus are patentable over *Toyoda* at least by virtue of their dependency.

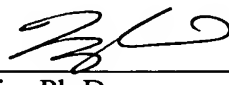
## II. Conclusion

From the foregoing, further and favorable action in the form of a Notice of Allowance is believed to be next in order and such action is earnestly solicited. If there are any questions concerning this paper or the application in general, the Examiner is invited to telephone the undersigned at his earliest convenience.

Respectfully submitted,

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